SYSTEM AND METHOD FOR INDICATING A STATUS OF MULTIPLE FEATURES OF A DATA PROCESSING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

This patent application is related to US Patent Application Serial No. 09/906,351 entitled "System and Method for Indicating a Status of Multiple Features of a Data Processing System," which was filed on July 16, 2001, is assigned to the assignee of the present application, and is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Technical Field:

The present invention relates in general to data processing systems, and more particularly, monitoring of data processing systems. Still more particularly, the present invention relates to a system and method for displaying the status of data processing system features.

2. Description of the Related Art:

The tree structure view is an increasingly popular view of hierarchical relationships of data and/or features of a data processing system. For example, the Microsoft Windows™ 95/98/NT/2000/ME operating systems implement a system management interface and directory listings in a tree structure view.

In a system management interface **100**, as depicted in **Figure 3A**, hierarchical relationships are typically illustrated by depicting an icon **102** and a textual identification **104** that represents a root feature. A feature is herein defined as "a unique, attractive, or desirable property of a program or of a computer or other hardware." Related and/or

dependent features are depicted in a similar fashion, but are indented below the root feature. Icons **102** are generally redundant with the textual identification **104** and do not add additional information. Typically, icon **102** is colorful and detailed, which generally distracts the user from relevant information displayed in the tree structure.

Users (e.g., network administrators) frequently monitor the data processing system features for a change of states. System management interface **100** illustrated in **Figure 3A** displays a graphical notification of a notification state to the user by simply adding a small overlay icon to icon **102**. The small overlay icons must compete with the already cluttered system management interface to alert the user of a change of the state of a feature of the data processing system. The first overlay icon is a warning icon **106** that indicates that the specified feature has encountered a condition where a program error and/or hardware failure may occur, herein referred to as a "warning status." The second overlay icon is an error icon **108** that indicates that the specified feature has encountered a program error and/or hardware failure, herein referred to as an "error status."

The cluttered system management interface requires tedious visual discrimination between highly similar icons to detect a change in operating conditions. Consequently, it would be desirable to provide an improved system and method for indicating the status of multiple features in a data processing system.

SUMMARY OF THE INVENTION

To overcome the foregoing and additional limitations in the prior art, the present invention provides an improved data processing system and method for indicating the status of multiple features within the data processing system. The data processing system includes a processor, a memory, and a system resource monitor stored in the memory and executable by the processor.

The system resource monitor displays a multi-level tree structure where each level includes a textual identification of a respective one of multiple features in the data processing system. The features are monitored by the system resource monitor for information regarding the status of the features. If the information indicates a notification status (e.g., any status that requires a user to be notified), the system resource monitor displays one of various graphically distinct notification indicia in place of the placeholder icon. If the monitored status includes more than one attribute, the placeholder icon and notification indicia are displayed in a window adjacent to the tree structure.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself however, as well as a preferred mode of use, further objects and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

Figure 1depicts a block diagram of an exemplary data processing system, which may be utilized to implement the present invention;

Figure 2 illustrates a layer diagram of the software utilized to implement a preferred embodiment of the present invention;

Figure 3A depicts a graphical user interface (GUI) of a system manager according to the prior art;

Figure 3B illustrates a GUI of a system resource monitor in accordance with a first preferred embodiment of the present invention;

Figure 4A depicts a GUI of a system resource monitor in accordance with a preferred embodiment of the present invention;

Figure 4B illustrates a GUI of a system resource monitor in which a window displaying multiple attributes can be resized utilizing a resizing tool in accordance with a preferred embodiment of the present invention;

Figure 4C depicts a GUI of a system resource monitor in which the display order

of a set of columns may be altered in accordance with a preferred embodiment of the present invention;

Figure 4D illustrates a GUI of a system resource monitor in which a selection of viewable attributes may be made utilizing a pull-down menu in accordance with a preferred embodiment of the present invention;

Figure 4E depicts a GUI of a system resource monitor in which a hovering title bar description is displayed in accordance with a preferred embodiment of the present invention;

Figure 4F illustrates a GUI of a system resource monitor in which the title bar descriptions are textual descriptions in accordance with a preferred embodiment of the present invention; and

Figure 5 depicts a high-level logic flowchart of a method of indicating a status of a respective one of a plurality of features within a data processing system to a user in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference now to the figures and in particular with reference to **Figure 1**, there is depicted a detailed block diagram of a data processing system **10** in which a preferred embodiment of the present invention may be implemented. As illustrated, data processing system **10** includes a DASD **22**, CPU **24**, memory **26**, user interface **28**, communication control unit **36**, and multiple components **40a-40n** coupled by a system interconnect **20**. It should be readily apparent to those skilled in the art that system interconnect **20** may be implemented as one or more buses, switches or any other type of coupling apparatus. Central processing unit (CPU) **24**, which may be implemented as one or more processors, such as any generation of Pentium™ processor available from Intel Corporation in Santa Clara, CA, executes software instructions to control the operation of data processing system **10**.

Memory **26** provides storage for software and data and may include both read-only memory (ROM) and random access memory (RAM). Direct access storage device (DASD) **22** provides additional non-volatile storage for data processing system **10**. DASD **22** may include, for example, a CD-ROM, a CD-RW, a DVD disk drive, a hard disk drive, and/or a floppy disk drive.

User interface **28** provides an interface between data processing system **10** and peripherals employed by a user to interact with data processing system **10**. User interface **28** may include various adapters and drivers for controlling peripherals, such as keyboard **30**, display **32**, and mouse **34**. Communications control unit **36** provides an interface between data processing system **10** and an external network **38**, which may be a local area network (LAN) or a wide area network (WAN) such as the Internet. Components **40a-40n** can be any type of peripheral, such as additional controller cards or adapters.

Referring to now **Figure 2**, an exemplary layer diagram of the software configuration of data processing system **10** is illustrated. As well known in the art, a data processing system requires a set of program instructions, known as an operating system, to function properly. Basic functions (e.g., saving data to a memory device or controlling the input and output of data by the user) are handled by operating system **50**, which may be at least partially stored in memory **26** and/or DASD **22** of data processing system **10**. A set of application programs **56** for user functions (e.g., e-mail programs, word processors, Internet browsers), runs on top of operating system **50**. As shown, system resource monitor **54** and application programs **56** access the functionality of operating system **50** via an application program interface **52**. Alternatively, system resource monitor **54** can be implemented as part of operating system **50**, or as middleware **53**.

With reference to **Figure 3B**, there is depicted a graphical user interface (GUI) of system resource monitor **54**, herein referred to as system resource monitor interface **150**. As shown, multiple features of data processing system **10** are organized in a multi-level tree structure **162**. For example, CPU **24**, user interface **28**, and components **40a-40n** are considered hardware features, while operating system **50** and application programs **56** are examples of software features. Multi-level tree structure **162** is a data structure including one or more nodes that are linked together in a hierarchical fashion. A root node, or the base of multi-level tree structure **162**, can have related child nodes. By selecting a first expansion block **164** displaying a "+" sign next to a root node in system resource monitor interface **150** utilizing mouse **34**, the user invokes display of all related child nodes. However, if a second expansion block **166** displaying a "-" sign next to a root node is selected by the user utilizing mouse **34**, all child nodes related to the root node are hidden from the user to present a simplified view of multi-level tree structure **162**.

Features of the data processing system are monitored by system resource monitor

54 for one of two states: a normal status or a problem status. Features such as "Inventory" **152**, herein referred to as "root features," occupy the top of a multi-level tree structure **162**. Indented below and related to the independent features are "child features," such as "basic system" **154**. System resource monitor interface **150** displays a placeholder icon **168** and a textual identification **156** of a feature if system resource monitor **54** observes a normal status from the feature. However, if system resource monitor **54** observes a notification status from the feature, various graphically distinct indicia are displayed next to textual identification **156** of the feature by system resource monitor interface **150**, depending on the type of notification status. Notification indicia **158** and **160** are graphical icons implemented as bitmaps.

Referring to **Figure 4A**, there is depicted a graphical user interface (GUI) for system resource monitor **54**, herein referred to as system resource monitor interface **300**, which facilitates the visual discrimination of notification indicia, in the case when the monitored status includes multiple attributes, according to a preferred embodiment of the present invention. As shown, multiple features of data processing system **10** are organized in a multi-level tree structure **302**. Features such as "Line of Business: Container" **308** are considered root features and occupy the top level of tree structure **302**. Indented below and related to the independent features are "child features," such as "Line of Business: Customer" **310**. Features of the data processing system are monitored by system resource monitor **54** in order to provide an indication of the status of the feature. However, this status may include more than one attribute. System resource monitor **54** determines whether or not each observed attribute is in a normal or notification state. Some of the attributes monitored by system resource monitor **54** are indicated in a title bar **322** of window **320** adjacent to multi-level tree structure **302**. Window **320** further includes rows that indicate to the user the status (and the setting of each attribute) of each feature of the data processing system. The columns in window **320** designate the various attributes that comprise the status of a data processing system

feature.

During feature status monitoring by system resource monitor **54**, system resource monitor interface **300** displays a "blank" placeholder icon **312** or other indicator of normal state in a correct row and column of window **320** if an attribute has a normal state. However, if system resource monitor **54** observes a notification state from the feature's attribute, various graphically distinct indicia are displayed in window **320** in a field corresponding to the monitored feature, depending on the type of notification state. Notification indicia **316** and **318** are graphical icons implemented as bitmaps.

For example, referring again to **Figure 4A**, system resource monitor interface **300** includes feature "Operating System: H001" **350**. Window **320**, adjacent to tree structure **302** includes a row directly adjacent to "Operating System H001" **350** that reports the status of the feature. The status comprises four attributes: an (1) operational state, a (2) message alert state, a (3) security state, and a (4) a scheduling state. A warning indica **352** displayed in the operational state attribute space indicates to the user that the "Operating System: H001" **350** may have encountered a condition in which a program error and/or hardware failure may occur. The feature "Operating System: H001" **350** may also have a message that requires user attention, as indicated by message indica **354**. Locked indicia **356** determines that the feature has a locked (e.g., password protected) security setting. Finally, placeholder icon **358** indicates that the feature has no scheduled tasks. This combination of attributes clearly indicates the status of the data processing system feature.

As in many program interfaces, the user may alter the appearance of system resource monitor interface **300**. With reference to **Figure 4B**, there is illustrated a view of system resource monitor interface **300** in which window **320** may be sized utilizing sizing tool **324**, controlled by mouse **34**. The user may choose to view more of the

textual identifications of tree structure **302** by reducing the viewable area of window **320**. **Figure 4C** illustrates that the visual appearance of system resource monitor interface **300** may further be customized by altering the viewable order of the columns in window **320** utilizing mouse **34** to click and drag column **325** to the desired location.

With reference to **Figure 4D**, there is illustrated another view of system resource monitor interface **300** in which the user may select to view only the desired attributes by utilizing pull-down menu **326**, which may be invoked by clicking the right button of mouse **34** on title bar **322**. When an attribute is listed on pull-down menu **326** with an adjacent checkmark **328**, the attribute is viewable in window **320**. The attribute column may be removed from view by deselecting the attribute on pull-down menu **326**.

Referring to **Figure 4E**, there is depicted another view of system resource monitor interface **300** in which "hover help" is invoked. Utilizing mouse **34**, the user may place the mouse cursor over a section of title bar **322**. After waiting a few seconds, hover help bar **330** appears to describe (utilizing text) notification indicia **332** in title bar **322**, as indicated by the mouse cursor.

Referring the **Figure 4F**, there is depicted another view of system resource monitor interface **300** in which a second view of title bar **322** may be invoked by the user. This second view includes text descriptions **334** instead of graphical indicia in title bar **322**.

Referring now to **Figure 5**, a high-level logic flowchart depicting a preferred method of indicating to a user the status of multiple features within a data processing system is illustrated. The preferred embodiment of the present invention can implement the feature status indication method utilizing a system resource monitor **54** stored in memory **26** and executable by CPU **24** of data processing system **10**. The preferred

method of indicating a status of multiple features results in the display of a multi-level tree structure including indications regarding the status of the components in the data processing system.

The process begins as illustrated in block **400** and continues to block **402**, which depicts the display of a multi-level tree structure. Each level of the multi-level tree structure includes a textual identification for a respective one of multiple features within data processing system **10**. Next, the process enters a monitoring loop including blocks **404-412**. As depicted in block **404**, a system resource monitor observes the multiple features within data processing system **10** for information regarding a status of one of the multiple features. A textual identification of each of the features is displayed by system resource monitor **54**, as illustrated in block **405**.

If the information indicates a normal state, as illustrated in block **406**, the process continues to block **408**, which depicts the system resource monitor displaying a placeholder icon in a correct row and column in a window adjacent to the multi-level tree structure. The process returns to block **404** from block **408**. If, as illustrated in block **410**, the information indicates a notification state, the system resource monitor displays one of various graphically distinct indicia providing indication of an attribute of the feature in the window adjacent to the multi-level tree structure, as shown in block **412**. The process returns to block **404** from block **412**.

As described above, an improved system and method for indicating a status of multiple features within a data processing system to a user is presented. An exemplary data processing system, as implemented according to a preferred embodiment of the present invention, includes a system resource monitor, stored in a memory and executable by a processor. The system resource monitor observes the status of the features and displays various graphically distinct indicia on the system resource monitor

interface depending on the status of the features. The user can clearly ascertain the status of multiple features of a data processing system because the system resource monitor displays a textual identification of the feature and a placeholder icon if the feature is functioning normally. When the system resource monitor observes a notification status for a feature, various graphically distinct indicia are displayed adjacent the textual identification of the feature by the system resource monitor. If the status of at least one of the multiple features comprises multiple attributes, system resource monitor displays a window adjacent to the multi-tree structure. System resource monitor displays in the window a placeholder icon for attributes having a normal state and a notification icon for attributes having a notification state.

Although aspects of the present invention have been described with respect to a computer system executing software that directs the functions of the present invention, it should be understood that present invention may alternatively be implemented as a program product for use with a data processing system. Programs defining the functions of the present invention can be delivered to a data processing system via a variety of signal-bearing media, which include, without limitation, non-rewritable storage media (e.g., CD-ROM), rewritable storage media (e.g., a floppy diskette or hard disk drive), and communication media, such as digital and analog networks. It should be understood, therefore, that such signal-bearing media, when carrying or encoding computer readable instructions that direct the functions of the present invention, represent alternative embodiments of the present invention.

While the invention has been particularly shown and described with reference to a preferred embodiment, it will also be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.